

APPENDIX V



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NEW BEDFORD HARBOR PILOT STUDY
PRE-OPERATIONAL MONITORING - PROGRESS REPORT:

Chemical Analysis Results of Water Samples Collected
During September 1987.

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INTRODUCTION

Seawater samples for chemical analysis were collected from New Bedford Harbor on September 24 and September 28 1987. Composite samples from ebb and flood tides were obtained on each day from four stations in the harbor. The samples were analyzed for polychlorinated biphenyls (PCBs), copper (Cu), cadmium (Cd) and lead (Pb).

On September 24, samples were collected at Stations 1,3 and 4 once per hour for 5 hours during the ebb and flood tides. These samples were composited and analyzed for whole water PCBs, Cu, Cd and Pb. At Station 2 the hourly samples were filtered and composites made of the dissolved and particulate phases for both ebb and flood tides. A whole water composite was also analyzed for metals. On this date, to obtain an estimate of the spatial variability at Station 2, samples were taken from both the east and west sides of the channel and at the surface, middle, and bottom of the water column three hours after low tide (L+3) and three hours after high tide (H+3). These samples were analyzed individually and portions combined into two composites, one for three hours after low tide and one for three hours after high tide.

On September 28, 1987 whole water grab and composite samples and the dissolved and particulate composite samples were collected. These samples were all analyzed for PCBs, Cu, Cd and Pb. In order to evaluate temporal variability, individual whole water samples were taken at Station 2 in conjunction with the hourly sampling for the whole water, dissolved and particulate composite samples. A whole water composite was taken for metals analysis but not for PCBs.

METHODS AND MATERIALS

The methods and materials used for these analyses were similar to those described in the report for the July cruises in New Bedford Harbor (Palmquist et al., 1987).

RESULTS AND DISCUSSION

PCBs

The PCB results for samples collected on September 24, 1987 are shown in Table 1. Compositing whole water samples from the ebb and flood tides were analyzed from each of Stations 1, 3 and 4. Dissolved and particulate composites were analyzed from Station 2.

The samples were analyzed for PCBs as Aroclors 1242 and 1254 and these concentrations were summed as a measure of Total PCBs. There were differences in the concentrations between the ebb and flood tides, with the flood tide showing slightly lower levels for total PCBs at each of the four stations.

The dissolved and particulate phase concentrations were added and this information is provided in the column labeled 'Sum'. A simple mean was taken of the values measured on the two tides at each station. This was done to allow an easier comparison of the concentrations reported at the four stations. These data show that the levels decrease from 0.758 at Station 1 to 0.102 at Station 4.

On September 28 samples were again collected five times during both the ebb and flood tides at each of the four stations. Compositing was done as for the September 28 samples and the results from these analyses are shown in Table 2. The data was summed for

particulates and solubles and a mean of tidal samples was taken for comparisons between stations. As was found on September 24, the concentrations decreased from Station 1 to Station 4. The trends and mean PCB levels measured on the two sampling dates were very similar.

The results of the September 24 sampling to determine spatial variability of PCB concentrations at Station NBH-2 are shown in Table 3. The mean of the hourly Total PCB concentration compares well with the composite for the ebb sample and appears slightly high of the flood composite. In general the surface sample of each of the four sample sets is the highest with no noticable pattern between the middle and bottom samples. Neither east or west of the center were very different from each other.

The results of the experiment to assess the temporal variability of PCBs at Station 2 are shown in Table 4. The values range from a low of 0.227 ug/l to a high of 0.943 ug/l for Total PCBs and may show a trend toward being lowest at high tide and highest at low tide with variable concentrations during the ebb and flood.

The concentrations of thirteen individual PCB congeners were also measured in all of the samples that were analyzed. A listing of the congeners quantified is provided in Table 5. The levels of each of the congeners in the samples collected on September 24 are shown in Table 6 and in Table 7 for samples collected on September 28. The approximate detection limits for these congeners is 1 ng/liter. Additionally Tables 8 and 9 show the results of the spatial and temporal variability experiments conducted at Station 2.

These data will provide important information of the partitioning of compounds with known n-octanol/water partition coefficients. Such discussions are, however, beyond the scope of this report.

METALS

The trace metal results for the whole water samples collected in September are shown in Table 10. These results are very similar to those reported in July for both concentration range and station variability. Stations 1-3 consistently showed higher levels for the three metals analyzed than did Station 4, and the concentrations tended to be higher at Stations 1 and 3 than at Station 2.

The partitioning of each metal between the soluble and particulate phases was only measured at Station 11 in September and the results for Cu and Cd were consistent with those encountered in July at that station. Cd was primarily found in the soluble phase and Cu was equally distributed between the two phases. In July, Pb was equally distributed between the soluble and particulate phases, however, in September there was about 2-3 times more particulate compared to soluble lead.

Tables 11 and 12 summarize the data from the two specialized samplings that were done in September at Station 2. These include results for whole water metals concentrations for samples collected from the surface, middle, and bottom of the water column on the east and west sides of Station 2. This series of samples was collected on September 24, 3 hours after high and low tides. The data for individual samples along with means are given in Table 11.

Table 12 summarizes the results for the individual whole water hourly samples collected on September 28. The means for these samples and the results for the regular hourly composites at Station 2 during the ebb and flood tides are also shown. The results for both studies show some variability however it is within the range of variability found for the composite samples from this station. No consistent patterns of distribution were found for the depth profiles. The only pattern found in the hourly samples was a trend towards increased Cd as the tide was ebbing followed by a decrease in concentrations during the flood tide. This trend is consistent with the composite sample results for Cd for both July and September, Cd was found to be highest at Station 2 during the ebb tide. This change in concentration over time was not seen for Pb or Cu.

CONCLUSIONS

PCBs measured as both Aroclor 1242 and Aroclor 1254 were detected in seawater samples from New Bedford Harbor. Individual PCB congeners were found ranging from tetrachlorobiphenyls through heptachlorobiphenyls in most samples. The higher molecular weight congeners were generally below detection limits in these samples. PCBs were found in both the dissolved and particulate phases of the samples. The measured concentrations were highest (approximately 1.0 ug/l) at Station 1 (north of the Coggeshall Street Bridge) and decreased with distance downbay to about 0.1 ug/l at the Hurricane Barrier (Station 4). These results, which compare well with the results of July sampling, indicate that the PCB levels in New Bedford Harbor are greatly elevated as far south as the Hurricane Barrier and all contained PCB levels above the U.S. EPA Marine Water Quality Criteria of 0.030 ug/l for PCBs.

The results from the September sampling for trace metals are very similar to the July results. The concentrations of all three metals, while variable, were consistently higher at Stations 1-3 than at Station 4. This pattern has been seen on all four sampling days. The results of the additional sampling at Station 2 were consistent with the composite samples normally taken at that station.

REFERENCES

Palmquist, R., K. Schewitzer, S. Fluck, R. Bowen and R.J. Pruell.
1987. New Bedford Harbor Pilot Study Pre-operational
Monitoring - Progress Report: Chemical Analysis Results From
the Two Pre-operational Water Samplings Conducted in New
Bedford Harbor during July of 1987.

Table 12. Trace metal results for New Bedford Harbor hourly samples collected 9/28/87 at the Coggeshall Street Bridge. Concentrations are as ug/kg.

	WWC-Cd	WWC-Pb	WWC-Cu
HIGH + 1	0.09	3.0	5.8
HIGH + 2	0.10	3.6	8.0
HIGH + 3	0.16	3.1	6.5
HIGH + 4	0.24	2.2	6.3
HIGH + 5	0.24	3.1	6.9
Mean	0.17	3.0	6.7
SD	(0.07)	(0.5)	(0.8)
EBB Composite	0.17	3.9	6.7
LOW + 1	0.15	1.3	5.9
LOW + 2	0.12	1.5	5.7
LOW + 3	0.10	2.2	6.4
LOW + 4	0.12	2.0	6.6
LOW + 5	0.08	1.6	5.4
Mean	0.11	1.7	6.0
SD	(0.03)	(0.4)	(0.5)
FLD Composite	0.14	4.8	9.1

EBB - ebb tide.
 FLD - flood tide.
 WWC - whole water sample.

Table 1. PCB concentrations in seawater samples collected from New Bedford Harbor on 9/24/87. Concentrations are as ug/l.

STATION	TIDE	SAMPLE	AROCLORS		TOTAL PCBs	SUM	MEAN
			1242	1254			
NBH-1	EBB	WWC	1.48	0.315	1.80		
NBH-1	FLD	WWC	1.17	0.302	1.48		1.64
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NBH-2	EBB	DISS	0.388	0.024	0.412		
NBH-2	EBB	PART	0.047	0.087	0.134	0.546	
NBH-2	FLD	DISS	0.245	0.017	0.262		
NBH-2	FLD	PART	0.075	0.095	0.170	0.379	0.462
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NBH-3	EBB	WWC	0.304	0.153	0.457		
NBH-3	FLD	WWC	0.198	0.105	0.303		0.380
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NBH-4	EBB	WWC	0.071	0.040	0.111		
NBH-4	FLD	WWC	0.070	0.037	0.107		0.109

EBB - ebb tide.
 FLD - flood tide.
 PART - particulate sample.
 DISS - dissolved sample.
 WWC - whole water sample.

Table 2. PCB concentrations in seawater samples collected from New Bedford Harbor on 9/28/87. Concentrations are as ug/l.

STATION	TIDE	SAMPLE	AROCLOR		TOTAL PCBs	SUM	MEAN
			1242	1254			
NBH-1	EBB	WWC	0.992	0.242	1.23		
NBH-1	FLD	WWC	0.561	0.161	0.722		0.976
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NBH-2	EBB	DISS	0.188	0.019	0.207		
NBH-2	EBB	PART	0.180	0.131	0.311	0.518	
NBH-2	FLD	DISS	0.190	0.018	0.208		
NBH-2	FLD	PART	0.080	0.103	0.183	0.391	0.454
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NBH-3	EBB	WWC	0.408	0.187	0.595		
NBH-3	FLD	WWC	0.333	0.124	0.457		0.526
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NBH-4	EBB	WWC	0.062	0.042	0.104		
NBH-4	FLD	WWC	0.083	0.022	0.105		0.104

EBB - ebb tide.
 FLD - flood tide.
 PART - particulate sample.
 DISS - dissolved sample.
 WWC - whole water sample.

Table 3. Spatial distribution of whole water PCBs collected on 9/24/87 at Station NBH-2. Concentrations are as ug/l.

				AROCLOR		TOTAL	MEAN (+/- SD)
				1242	1254		
EAST	H+3	S	WWC	0.773	0.141	0.914	0.608 (0.243)
EAST	H+3	M	WWC	0.231	0.076	0.307	
EAST	H+3	B	WWC	0.414	0.119	0.533	
WEST	H+3	S	WWC	0.762	0.131	0.893	
WEST	H+3	M	WWC	0.391	0.133	0.524	
WEST	H+3	B	WWC	0.353	0.124	0.477	
NBH-2	H+3	COMPOSITE		0.560	0.100	0.660	
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EAST	L+3	S	WWC	0.368	0.109	0.477	0.428 (0.127)
EAST	L+3	M	WWC	0.157	0.080	0.237	
EAST	L+3	B	WWC	0.221	0.101	0.322	
WEST	L+3	S	WWC	0.495	0.092	0.587	
WEST	L+3	M	WWC	0.411	0.092	0.503	
WEST	L+3	B	WWC	0.337	0.104	0.441	
NBH-2	L+3	COMPOSITE		0.198	0.080	0.278	

WWC - Whole water sample.

H+3 - Ebb hour 3

L+3 - Flood hour 3

S - Surface

M - Middle

B - Bottom

Table 5.

Listing of the PCB congeners that were quantified. The naming convention used is that described by Ballschmiter and Zell (1980).

CB052	-	2,2',5,5'-PCB
CB047	-	2,2',4,4'-PCB
CB101	-	2,2',4,5,5'-PCB
CB151	-	2,2',3,5,5',6-PCB
CB118	-	2,3',4,4',5-PCB
CB153	-	2,2',4,4',5,5'-PCB
CB138	-	2,2',3,4,4',5'-PCB
CB128	-	2,2',3,3',4,4'-PCB
CB180	-	2,2',3,4,4',5,5'-PCB
CB195	-	2,2',3,3',4,4',5,6-PCB
CB194	-	2,2',3,3',4,4',5,5'-PCB
CB206	-	2,2',3,3',4,4',5,5',6-PCB
CB209	-	CL10-PCB

Table 6. PCB congener concentrations in water samples collected from New Bedford Harbor on 9/24/87. Concentrations are as ng/l.

STATION	TIDE	KIND	CB052	CB047	CB101	CB151	CB118	CB153	CB138	CB128	CB180	CB195	CB194	CB206	CB209
NBH-1	EBB	WWC	66.4	36.8	40.4	5.34	40.5	23.9	15.8	4.01	2.66	0.00	0.00	0.00	0.00
NBH-1	FLD	WWC	54.2	30.7	36.7	5.02	39.6	22.7	15.3	3.97	2.45	0.00	0.00	0.00	0.00
NBH-2	EBB	PART	7.29	4.07	10.6	1.56	13.1	9.80	5.99	1.92	1.16	0.00	0.00	0.00	0.00
NBH-2	EBB	DISS	20.5	10.5	8.88	1.15	4.73	3.14	2.49	0.00	0.00	0.00	0.00	0.00	0.00
NBH-2	FLD	PART	8.56	4.63	11.8	1.52	13.0	9.34	6.30	1.92	1.23	0.00	0.00	0.00	0.00
NBH-2	FLD	DISS	14.9	7.85	8.11	1.29	3.80	2.46	1.87	0.00	0.00	0.00	0.00	0.00	0.00
NBH-3	EBB	WWC	22.1	12.4	20.6	3.15	18.0	13.4	11.3	2.70	1.61	0.00	0.00	0.00	0.00
NBH-3	FLD	WWC	16.6	10.0	14.5	1.51	14.3	8.03	6.52	1.79	0.00	0.00	0.00	0.00	0.00
NBH-4	EBB	WWC	8.51	5.84	5.77	0.00	4.76	3.25	2.26	0.00	0.00	0.00	0.00	0.00	0.00
NBH-4	FLD	WWC	5.87	3.88	4.55	0.00	4.47	2.31	1.62	0.00	0.00	0.00	0.00	0.00	0.00

EBB - ebb tide.
 FLD - flood tide.
 PART - particulate sample.
 DISS - dissolved sample.
 WWC - whole water sample.

Table 7. PCB congener concentrations in water samples collected from New Bedford Harbor on 9/28/87. Concentrations are as ng/l.

STATION	TIDE	KIND	CB052	CB047	CB101	CB151	CB118	CB153	CB138	CB128	CB180	CB195	CB194	CB206	CB209
NBH-1	EBB	WWC	48.9	28.4	32.5	3.98	41.3	20.7	13.1	3.54	2.22	0.00	0.00	0.00	0.00
NBH-1	FLD	WWC	28.5	16.9	20.9	2.05	25.3	12.6	8.44	2.11	1.32	0.00	0.00	0.00	0.00
NBH-2	EBB	PART	16.0	9.01	17.7	2.43	18.1	12.7	8.03	2.35	1.51	0.00	0.00	0.00	0.00
NBH-2	EBB	DISS	10.8	4.81	5.81	0.00	3.75	2.27	1.90	0.00	0.00	0.00	0.00	0.00	0.00
NBH-2	FLD	PART	9.54	5.30	13.3	1.82	14.3	10.1	6.81	1.99	1.14	0.00	0.00	0.00	0.00
NBH-2	FLD	DISS	10.5	6.18	5.72	1.38	4.09	1.92	1.43	0.00	1.03	0.00	0.00	0.00	0.00
NBH-3	EBB	WWC	27.0	15.8	24.2	3.30	25.1	14.2	10.6	2.78	1.71	0.00	0.00	0.00	0.00
NBH-3	FLD	WWC	19.5	10.4	17.2	2.24	16.4	9.91	7.24	2.32	1.44	0.00	0.00	0.00	0.00
NBH-4	EBB	WWC	5.47	2.94	3.87	0.85	3.48	2.60	2.18	0.87	0.00	0.00	0.00	0.00	0.00
NBH-4	FLD	WWC	6.43	2.73	4.61	0.84	3.93	2.80	2.18	0.00	0.00	0.00	0.00	0.00	0.00

EBB - ebb tide.
FLD - flood tide.
PART - particulate sample.
DISS - dissolved sample.
WWC - whole water sample.

Table 8. Spatial distribution of whole water PCB congeners collected on 9/24/87 at Station NBH-2. Concentration are as n/l.

		CB052	CB047	CB101	CB151	CB118	CB153	CB138	CB128	CB180	CB195	CB194	CB206	CB209
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EBB HOUR 3														
EAST	S	36.0	17.4	23.5	2.60	21.2	14.1	8.18	2.25	1.42	0.00	0.00	0.00	0.00
EAST	M	13.4	6.11	9.65	1.13	10.7	8.29	5.64	1.69	1.19	0.00	0.00	0.00	0.00
EAST	B	24.4	12.4	19.1	2.35	19.4	12.6	8.56	2.30	1.18	0.00	0.00	0.00	0.00
WEST	S	40.1	19.5	25.2	2.69	22.7	15.2	9.28	2.48	1.42	0.00	0.00	0.00	0.00
WEST	M	21.0	12.5	16.2	1.86	19.7	9.40	6.56	1.82	1.16	0.00	0.00	0.00	0.00
WEST	B	23.3	13.6	17.1	2.12	17.6	9.73	6.58	1.63	1.08	0.00	0.00	0.00	0.00
COMPOSITE		32.6	15.9	22.4	2.65	20.8	13.7	7.36	2.77	1.41	0.00	0.00	0.00	0.00
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FLD HOUR 3														
EAST	S	23.7	13.4	16.6	1.91	15.9	8.82	6.13	1.67	0.00	0.00	0.00	0.00	0.00
EAST	M	10.5	6.73	8.24	1.07	8.57	5.51	4.17	1.02	0.00	0.00	0.00	0.00	0.00
EAST	B	15.0	9.21	13.8	1.49	13.6	7.26	5.39	1.54	0.00	0.00	0.00	0.00	0.00
WEST	S	22.8	11.3	16.3	2.04	14.0	8.60	5.98	1.73	0.00	0.00	0.00	0.00	0.00
WEST	M	25.8	12.7	19.1	2.27	16.0	9.96	6.96	2.01	0.00	0.00	0.00	0.00	0.00
WEST	B	20.7	10.4	18.0	2.22	15.6	10.1	7.31	2.22	1.04	0.00	0.00	0.00	0.00
COMPOSITE		14.6	7.17	12.4	1.31	12.4	8.02	5.77	1.63	1.25	0.00	0.00	0.00	0.00
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S	-	surface.												
M	-	middle.												
B	-	bottom.												
EBB	-	ebb tide.												
FLD	-	flood tide.												

Table 9. Temporal distribution of PCB congeners in seawater collected from New Bedford Harbor Station NBH-2 on 9/28/87. Concentrations are as ng/l.

TIDE	CB052	CB047	CB101	CB151	CB118	CB153	CB138	CB128	CB180	CB195	CB194	CB206	CB209
EBB HOUR 1	13.2	8.83	13.0	1.35	13.7	6.93	5.42	1.29	0.00	0.00	0.00	0.00	0.00
EBB HOUR 2	25.8	15.8	20.0	2.32	19.8	10.5	6.96	1.90	1.25	0.00	0.00	0.00	0.00
EBB HOUR 3	14.6	9.75	12.9	1.59	14.9	7.69	5.04	1.36	0.00	0.00	0.00	0.00	0.00
EBB HOUR 4	33.1	19.0	23.3	2.39	25.4	11.9	8.00	1.86	1.14	0.00	0.00	0.00	0.00
EBB HOUR 5	26.8	16.7	18.5	2.19	22.3	11.4	7.43	1.73	1.47	0.00	0.00	0.00	0.00
DISS COMPOSITE	7.29	4.07	10.6	1.56	13.1	9.80	5.99	1.92	1.16	0.00	0.00	0.00	0.00
PART COMPOSITE	20.5	10.5	8.88	1.15	4.73	3.14	2.49	0.00	0.00	0.00	0.00	0.00	0.00
SUM	27.8	14.6	19.5	2.71	17.8	11.9	8.48	1.92	1.16	0.00	0.00	0.00	0.00
FLD HOUR 1	40.9	24.8	34.9	3.39	38.2	18.5	12.7	3.21	1.54	0.00	0.00	0.00	0.00
FLD HOUR 2	24.9	14.9	19.2	1.73	18.7	9.88	6.46	1.78	1.12	0.00	0.00	0.00	0.00
FLD HOUR 3	30.3	17.7	21.7	2.46	21.2	10.5	6.98	1.73	1.12	0.00	0.00	0.00	0.00
FLD HOUR 4	20.9	12.6	17.2	1.91	17.0	8.71	6.05	1.49	0.00	0.00	0.00	0.00	0.00
FLD HOUR 5	11.6	8.32	13.0	1.58	14.6	7.77	5.32	1.27	0.00	0.00	0.00	0.00	0.00
DISS COMPOSITE	8.56	4.63	11.8	1.52	13.0	9.34	6.30	1.92	1.23	0.00	0.00	0.00	0.00
PART COMPOSITE	14.9	7.85	8.11	1.29	3.80	2.46	1.87	0.00	0.00	0.00	0.00	0.00	0.00
SUM	23.5	12.5	19.9	2.81	16.8	11.8	8.17	2.73	1.23	0.00	0.00	0.00	0.00

EBB - ebb tide.
 FLD - flood tide.
 PART - particulate sample.
 DISS - dissolved sample.

Table 10. Trace metal results for seawater samples collected from New Bedford Harbor. Concentrations are as ug/kg.

			Cd	Pb	Cu
9/24/87					
NBH-1	EBB	WWC	0.27	3.7	12.8
NBH-1	FLD	WWC	0.37	4.2	10.5
NBH-2	EBB	WWC	0.26	3.3	5.1
		PART	0.028	1.3	2.1
		DISS	0.14	0.51	2.0
NBH-2	FLD	WWC	0.12	2.3	6.8
		PART	0.020	1.2	2.4
		DISS	0.12	0.48	2.1
NBH-3	EBB	WWC	0.28	2.4	7.5
NBH-3	FLD	WWC	0.31	2.4	8.9
NBH-4	EBB	WWC	0.14	0.7	4.2
NBH-4	FLD	WWC	0.14	1.2	3.9
9/28/87					
NBH-1	EBB	WWC	0.34	4.1	6.1
NBH-1	FLD	WWC	0.27	4.1	7.6
NBH-2	EBB	WWC	0.17	3.9	6.7
		PART	0.026	1.2	2.4
		DISS	0.17	0.32	2.4
NBH-2	FLD	WWC	0.14	4.8	9.1
		PART	0.015	1.4	1.9
		DISS	0.15	0.51	2.2
NBH-3	EBB	WWC	0.25	4.0	6.7
NBH-3	FLD	WWC	0.15	2.4	8.3
NBH-4	EBB	WWC	0.05	3.2	2.6
NBH-4	FLD	WWC	0.15	1.0	2.6

EBB - ebb tide.
 FLD - flood tide.
 PART - particulate sample.
 DISS - dissolved sample.
 WWC - whole water sample.

Table 11. Depth profile of Trace Metals collected on
9/24/87 at Coggeshall Street Bridge.
Concentrations are as ug/kg.

		WWC-Cd	WWC-Pb	WWC-Cu
HIGH + 3 hours				
EAST	Surface	0.20	2.3	4.6
	Mid	0.18	2.1	7.6
	Bottom	0.19	1.8	7.1
WEST	Surface	0.14	3.0	5.9
	Mid	0.20	3.7	4.6
	Bottom	0.13	2.1	7.6
	Mean	0.17	2.5	6.2
	SD	(0.03)	(0.7)	(1.4)
Composite - East + West		0.15	1.9	8.2
- EBB Hourly		0.26	3.3	5.1
LOW + 3 hours				
EAST	Surface	0.11	3.7	7.6
	Mid	0.12	4.5	8.1
	Bottom	0.13	3.5	6.8
WEST	Surface	0.11	4.8	9.7
	Mid	0.07	3.0	9.3
	Bottom	0.10	2.2	10.7
	Mean	0.11	3.6	8.7
	SD	(0.02)	(1.0)	(1.4)
Composite - East + West		0.10	4.2	7.2
FLD Hourly		0.12	2.3	6.8
EBB	- ebb tide.			
FLD	- flood tide.			
WWC	- whole water sample.			